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# A Tangent Plane

for Accurately Mapping Scotomata and the  
Fields of Fixation and Single Vision  
and for Indicating the Precise  
Position of Double Images  
in Paralysis.

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NEW YORK.

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A TANGENT-PLANE FOR ACCURATELY MAPPING SCOTOMATA AND THE FIELDS OF FIXATION AND SINGLE VISION AND FOR INDICATING THE PRECISE POSITION OF DOUBLE IMAGES IN PARALYSIS.\*

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The apparatus which I exhibit here was first shown before the New York Academy of Medicine in January, 1906. It was, therefore, projected and in use, before I had the opportunity of learning of a very similar device which Syms and Sinclair have employed and which they described in the *Ophthalmic Review* of the following May. There is, in fact, nothing specially original in the idea underlying the apparatus, but the application of the idea in its present form offers certain features which experience has shown to be of considerable practical utility.

The apparatus consists of a curtain, black on one side and white on the other. On the white side is drawn a perimetric chart consisting of a series of concentric circles and radiating lines. The concentric circles represent arcs of  $5^\circ$ ,  $10^\circ$ ,  $15^\circ$ , etc., calculated for a radius of 30 inches and projected on the tangent plane. By a simple device the curtain can be raised or lowered so that the common center of the system of circles can be placed directly opposite the patient's eye. The radiating lines represent the projections of the meridians (horizontal, oblique and vertical) taken for each  $15^\circ$ . The white surface is also covered with a checker board of foot and two inch squares.

The black surface is marked only by a white pin in the middle, indicating the center of the perimeter chart, and by white pins

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\* Exhibited before the American Ophthalmological Society, June, 1906.

around the edge, indicating the termini of the different meridians. This last feature I have borrowed from Syms and Sinclair. The frame is strong, light and portable, so as to be readily shifted from one side of the room to the other. It can also be taken apart for transportation. The curtain is 5 feet high and 4 feet 5 inches wide, giving a lateral range of  $40^\circ$ , an upward range of  $35^\circ$  and a downward range of  $52^\circ$ . The lateral range can be extended to  $55^\circ$  or  $60^\circ$  by a tape attached to either vertical arm of the frame and marked with a tangent scale of degrees.

#### USES OF THE APPARATUS.

A. *To Plot Central and Paracentral Scotomata.*—The patient is seated facing the black side of the curtain and exactly 30 inches from it, and the curtain is raised until the white pin is just opposite the eye to be tested. Directing him to fix the pinhead steadily, we carry the test-object (white pin, square of white paper, electric light, etc.) in from periphery to center, along each of the meridians in succession, i. e., we carry it from each marginal white pin in turn toward the white pin in the middle. The points where the test-object enters the scotoma and where it emerges from it in each meridian, are marked by thrusting black pins through the curtain. The plot of the scotoma thus outlined can then be taken off from the reverse side of the curtain, where the pins stick through, and can be transferred to a perimeter chart.

In some cases it will be advisable to plot scotomata on a larger scale than that here indicated, i. e., using a radius of one or even two meters instead of 30 inches. In such cases, of course, the perimeter chart on the reverse side is no longer applicable. We then must use the plan suggested by Syms and Sinclair, of measuring off the distance between each inserted black pin and the central white pin, using for this purpose a yardstick or tape marked with a tangent-scale calculated for the given radius. Such a tape I show here, marked on one side for a radius of 30 inches, on the other for a radius of 2 meters.

Not only scotomata, but also the limits of the field, when moderately contracted, and in any case, the limits of the color field, can be plotted with this apparatus, and that too very quickly.



B. *To Plot the Field of Fixation.*—The field of fixation is plotted in a very similar way. For this purpose the patient's head is fixed and in such a way that the eye in the primary position is directed precisely at the central white pin. The eye is then made to follow the test-object as far as it can along each meridian, the limit of its excursion in each case being marked by a pin thrust through the

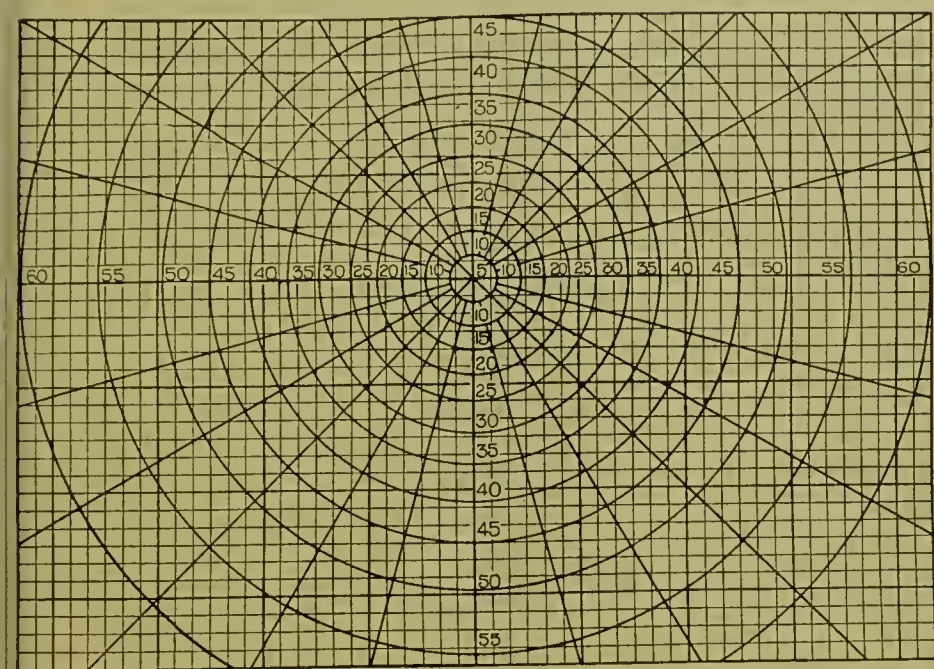


Fig. 1.—Chart used for plotting double images in paralysis, etc., and the field of fixation. The chart, which is  $5\frac{1}{4} \times 3\frac{3}{4}$  inches, is a precise facsimile of the reverse side of the curtain of the tangent plane, reduced to  $\frac{1}{20}$  of its natural size. The small squares of the checkerboard denoting two-inch intervals, the larger squares intervals of one foot. The circles represent intervals of  $5^\circ$ , and are drawn on the assumption that the patient is just 30 inches from the tangent plane. Under these conditions the checkerboard on the chart will correspond square for square to the checkerboard on the curtain, and a plot made on the latter by pins thrust into it to show the exact site of double images, the outlines of the field of single vision, the limits of the field of fixation, etc., can be transferred at once to the checkerboard on the chart.

curtain. The test-object in this case consists preferably of a pair of fine parallel lines on a small white card.

C. *To Mark Out the Field of Diplopia.*—The line separating the fields of single and double vision is similarly plotted. The test-object in this case is a small electric light like that here shown. The patient faces the screen as before, but with both eyes open and

with a red glass before one eye. With his head fixed he follows the light until it appears double. The point where this occurs on each meridian in succession is indicated by a pin inserted into the curtain.

By carrying the light on into the field of double vision the kind and amount of diplopia can be graphically shown. This is done by marking the situation of the light itself with a black pin and the situation of the double image (in this case the false image) with a white one. In this way we not only record the exact distance and

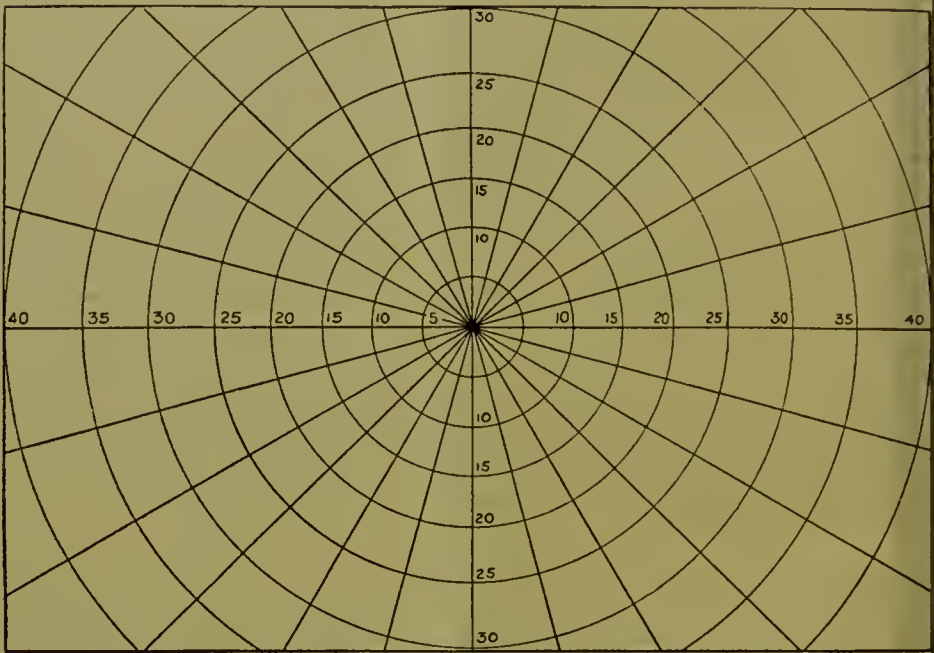


Fig. 2.—Chart used for plotting scotometer. Actual size of chart  $5\frac{3}{4} \times 3\frac{3}{4}$  inches. The meridians are drawn for every fifteen degrees, and the limits of the scotoma are indicated on each meridian by dots representing the pins thrust through the corresponding meridian on the tangent-plane curtain.

relative disposition of the double images, but also show which is the fixing eye. For if with the red glass before the right eye, the patient says that the point where we have actually placed the electric light looks red, it is evident that the right eye is fixing, while if it looks white the left eye is fixing.

In plotting the position of the double images, the checker board of 2 inch squares on the back of the curtain is a considerable help,



especially if, as in the specimen here shown, (Fig. 1) a chart is used that is similarly checkered. In general I use this kind for plotting double images and a chart drawn on double the scale for plotting scotomata (see Fig. 2). If the plot is made from the outline made by the pins on the reverse side of the curtain, we must remember to reverse it in the diagram, putting right for left and vice versa. After a little practice this is easy.

The advantages of the method are: 1. Accuracy.—In this regard it is vastly superior to the ordinary perimeter for plotting scotomata; and for indicating the double images in paralysis it excels any other plan that I know of. 2. Simplicity. 3. Thoroughness. 4. Rapidity.

